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TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS: ATLIN, BRITISH COLUMBIA

WORKING REPORT

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1. INTRODUCTION

Atlin is located in north-western British Columbia, on the east side of Atlin Lake and just south of the Yukon border (Figure 1). The project area consists of the town of Atlin and surrounding regions excluding areas that are part of the Agricultural Land Reserve or that have been designated for resource development.

The study was sponsored by the Ministry of Municipal Affairs, Planning Services. The purpose is to evaluate terrain characteristics, geological hazards and terrain capabilities for residential settlement in order to assist the Atlin Community Planning Group and government staff with preparation of zoning plans for the area.

Products include a map folio consisting of slope, terrain, geological hazards and terrain capability for residential settlements maps. The slope map depicts approximate slope classes for each surficial material described in any given terrain map unit. The terrain map describes the surfical materials, their texture, landform and geological processes affecting them for each terrain map unit. The geological hazards map identifies geological processes occuring in terrain map units that could be hazardous should that area be developed for settlement. The terrain capability for residential settlements map assigns numbers to terrain map units, the numbers referring the reader to the terrain capability interpretations given in Appendix A of this report.

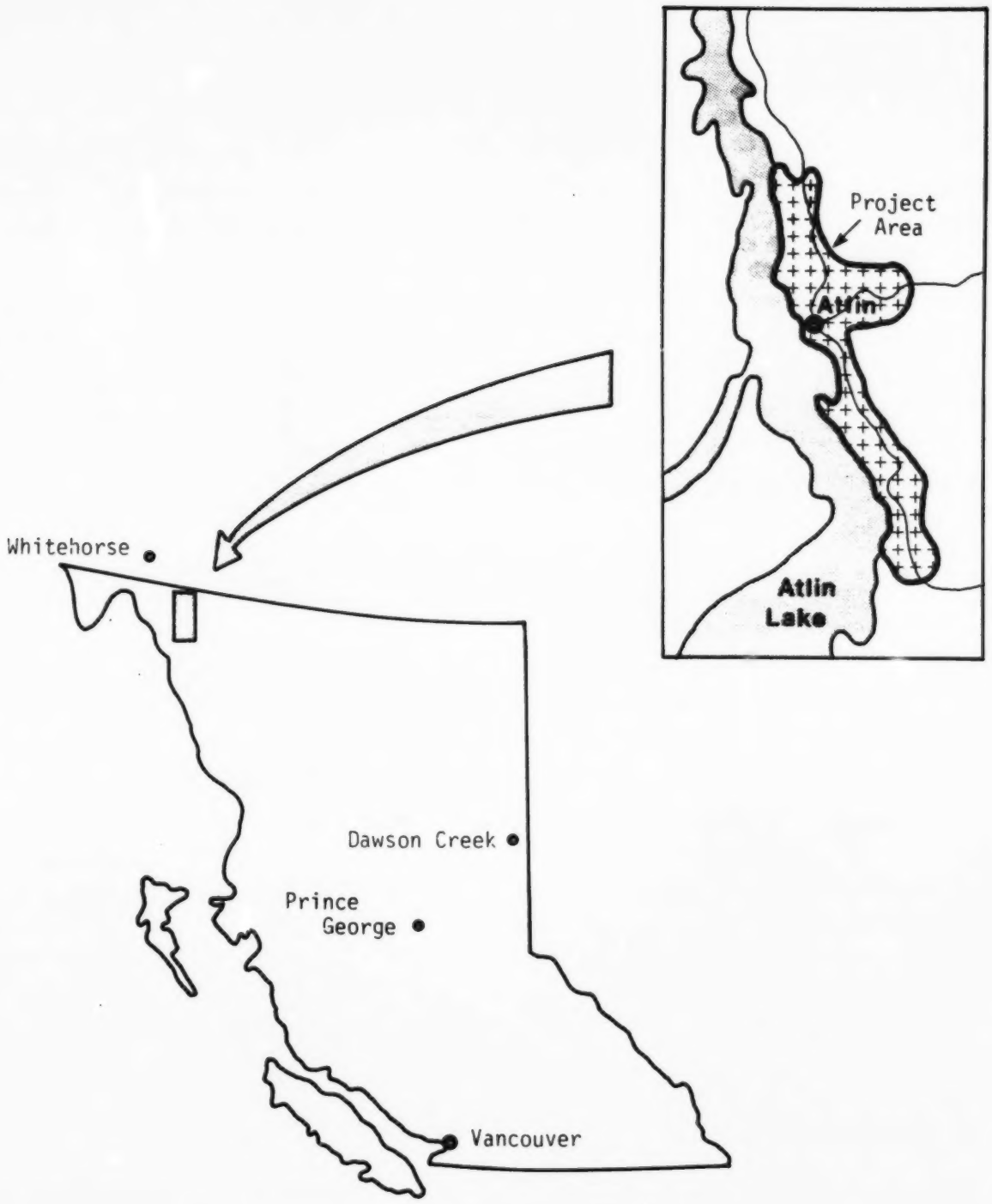

Figure 1. Location Map of the Atlin Project Area.

2. METHODOLOGY

The Atlin area was surveyed at a 1:50 000 (reconnaissance) scale and mapped according to the Terrain Classification System (E.L.U.C. Secretariat, 1976) to characterize the surficial materials. This system identifies various types of surficial materials (unconsolidated deposits), provides data related to their texture and landform and describes geomorphic processes evident in the area.

Initially 1:70 000 scale black and white aerial photography was examined stereoscopically to delineate map units (polygons) of surficial materials and to make a preliminary evaluation of the surficial materials in each map unit. Some mapped units are complex, containing a variety of surficial materials and landforms, while others are simple.

The field survey program for the Atlin project involved eight days of checking designated map units to confirm or to modify the initial surficial materials designations. In addition, additional data on the physical characteristics of the surficial materials was gathered, as was data on slopes, hydrologic regime and geological hazards. Observations were recorded at 139 sites and ten samples were collected for soil engineering analysis (grain size analysis, Atterberg Limits) (Table 1, Map 4).

Following the field survey and laboratory processing of samples, the field and lab data were compiled on a 1:50 000 scale map using the Terrain Classification System (Map 2). Slope classes defined for a similar study at Kootenay Bay - Crawford Bay (Pedology Consultants, 1981), with minor modification, have also been utilized in this study (Map 1). These particular slope classes are compatable with the system used to evaluate settlement suitability (Maynard, 1979), as well as being classes significant in local geological harzards assessment (Ryder, 1980, 1981).

Geological hazards (Map 3) have been interpreted from the Terrain Map (Map 2) according to the "Method for Preparation of a Geological Hazards Map" (Ryder, 1980, 1981). This method identifies terrain units subject to presently active hazardous geomorphical processes and, as well those with recognizable potential for hazards to occur in the future. Hazards documented for a given map unit do not necessarily affect all of the map unit, nor each of the surficial materials found in that unit.

All of the above information has been used to define and map "Terrain Capability for Residential Settlements" (Maynard, 1979). Terrain units (Map 2) having the same, or similar combinations of surficial materials, slopes and hazards, have been grouped on Map 4 and assigned numbers for convenience of reference. The numbers of the map units on Map 4 are used to refer the reader to the descriptions of the physical characterisics of the surficial materials and the "Terrain Capability for Residential Settlements" interpretations given in Appendix A. Interpretations established as being pertinent to land use planning in the Atlin area include terrain capability for: septic tank filter fields, foundations for low dwellings, road and street subgrade, ease of excavation and sanitary landfill.

Each numbered map unit was assessed for the above land uses and subjectively rated as having a High, Moderate or Low capability for each land use on the basis of the physical data mapped for that unit (Maynard, 1979).

3. GENERAL CHARACTERISITICS OF SURFICIAL MATERIALS

This section describes the types of surficial materials found in the study area. It elaborates upon some of their significant physical properties, their local distribution and common landforms associated with each type of material. In general, most of the surficial materials are related to the most recent glacial episode, the Fraser Glaciation and events that followed this glaciation (recent epoch).

3.1 MORAINAL MATERIALS (TILL)

Till is the material transported beneath, beside, or within and in front of a glacier. It is deposited directly from the glacier and not modified by any intermediate agent.

Till is the most common unconsolidated material in the Atlin area, occurring extensively on the gentle slopes east of Atlin Lake, on rock knolls north and south of town and on valley bottoms. Tills most commonly form mantles of varying thicknesses over rock (Mb, Mv, Mvb) and in lower topographic positions are often partially buried beneath other unconsolidated materials ($\frac{gF^{G}ft}{M}$, $\frac{Ovl}{M}$, etc.).

Two types of till were mapped in the Atlin area, basal till (material deposited beneath glaciers) and ablation till (material deposited as a result of the downwasting of glacier ice).

The basal till generally consists of a weathered upper stratum (solum) that is relatively loose, non-compact and relatively permeable. The unweathered (basal) portion of the till is commonly compact, relatively impermeable and restricts drainage. Soil water tends to move downslope along the upper surface of the unweathered till, a situation that may lead to slippage on cutfaces under wet soil conditions. In areas of relatively flat topography, a perched water table may develop above the unweathered basal till.

The basal tills of the Atlin area generally have a silty sandy matrix texture (considering only grain sizes of <2 mm). When all grain sizes are considered, most basal tills in the Atlin area have silty gravelly textures (82-2983, 2988, 2992 Table 1) (Unified Textures GM, GM-GC, GC). Basal tills that incorporate pre-Fraser glaciation fluvioglacial or fluvial gravels occur locally and have gravelly textures (82-2984, 2990, Table 1) (Unified Textures GM-GC, GC).

TABLE 1: TEXTURAL ANALYSIS AND ATTERBERG LIMITS FOR ATLIN AREA SURFICIAL MATERIAL SAMPLES

Sample Number	Surfical Material	% Coarse Fragments >2 mm	% Sand 2-.0625 mm	% Silt .0625-.002 mm	% Clay <.002 mm	Liquid Limit	Plastic Limit
82-2983	till	34.08	30.68	32.04	3.20	16.41	14.59
82-2984	till	57.28	21.64	15.14	5.94	21.67	14.89
82-2985	glacio-lacustrine	0.85	1.80	68.84	28.51	33.22	21.43
82-2986	glacio-lacustrine	0.00	2.83	70.17	27.00	36.47	23.45
82-2987	fluvio-glacial	83.40	13.31	2.78	0.51	0.00	0.00
82-2988	till	34.85	27.72	31.21	6.29	20.38	14.55
82-2989	fluvio-glacial	44.31	51.23	3.99	0.47	0.00	0.00
82-2990	till	61.78	18.82	14.01	5.39	23.18	15.78
82-2991	glacio-lacustrine	87.79	7.20	4.53	0.48	71.83	57.68
82-2992	till	43.71	25.32	25.05	5.92	18.42	14.50

Unweathered basal till is compact and relatively resistant to shear and deformation due to preconsolidation by glacial ice. However, Atlin area basal tills are generally weakly plastic (liquid limits 16-23% Table 1) and thus when wetted may locally be subject to deformation and shear failure, especially on large cutfaces, or on fill.

The ablation till mapped near the mouth of Fourth of July Creek is loose, non-compact and permeable. It has a gravelly texture (hand texture estimate) with a relatively high proportion of boulders and cobbles.

3.2 FLUVIOGLACIAL MATERIALS

Fluvioglacial materials are fluvial materials that were deposited in contact with glacier ice and which commonly show evidence of ice melting such as kettles and irregular topography. Large deltas and terraces of fluvioglacial gravels occur at Pine, Kennedy and McKee Creeks. These deltas formed where glacial rivers flowing from the mountains to the east dumped their sediment load into glacial Lake Atlin, ponded against the Atlin glacier. The highest shoreline of this lake stood at approximately 810 m (2660 ft) (British Columbia Ministry of Mines, 1936). A kame terrace with numerous large kettles occurs between Blackbear Creek and Como Lake where a now abandoned glacial channel of Pine Creek (Map #2) spread gravels on the surface of a stagnant lobe of the Atlin glacier. Fluvioglacial gravels deposited as outwash plains often also fill the swales between till and rock capped hills, as seen at Kennedy Creek and at North and South Lakes. The deltas and terraces commonly have a subdued to flat upper surface, often characterized by numerous shallow, abandoned stream channels. Both deltas and terraces have steep escarpments where they butted against glacier ice, or where subsequently incised by streams.

Sampled fluvioglacial gravels had from 44-83% coarse fragments (mixed pebbles and cobbles, with lesser boulders), 13-51% sand and only 3-4% silts and

clays (82-2987, 2989, Table 1). Typical Unified Textures include GP, GW and less commonly SP and SW.

The fluvioglacial gravels are non-plastic (Table 1), non-consolidated and because of their relatively coarse textures, have good bearing capacities. They drain readily and commonly are dry sites. Veneers of silts and fine sands in the abandoned channels on delta and terrace surfaces may be plastic when wet and consequently have less favourable bearing characteristics.

3.3 FLUVIAL MATERIALS

Fluvial surficial materials are those transported and deposited by streams and rivers (alluvial materials). In the Atlin area the most common fluvial deposits are relatively large aggrading fans on McKee, Pine and Fourth of July creeks. The fans on McKee and Pine creeks result from re-deposition of sediments eroded from placer mining operations upstream. Field examination suggests that the fans are subject to annual or at least, periodic flooding. Channel shifting is common, as is sediment deposition. The surfaces of the fans are multi-channelled and braided with a recurring pattern of low relief channels and terraces. Elsewhere, the creeks in the project area generally are incised with little floodplain, or the floodplains have been placer mined and consequently were mapped as anthropogenic materials (Map 2).

The fluvial materials of the Atlin area were not sampled for textural and Atterberg Limit analysis. According to hand texture estimates they are dominantly gravelly in texture (dominated by pebbles with lesser cobbles). Unified Textures are estimated to be GP, GW, and GM. The fluvial materials are non-consolidated, loose, non-plastic and drain readily. However, alongside creeks the water table may be near or above the surface, at least seasonally.

3.4 GLACIOLACUSTRINE MATERIALS

Glaciolacustrine materials are lacustrine materials that were deposited in contact with glacier ice, or which contain evidence of deposition within close

proximity to glacier ice. Two types of glaciolacustrine materials occur in the Atlin area; pebbly glaciolacustrine beach gravels that commonly mantle morainal deposits and bedrock to elevations of approximately 733 m (2400 ft), and clayey silty textured glaciolacustrine materials deposited in standing water in glacial Lake Atlin, to an elevation of approximately 715 m (2350 ft). The latter materials are evident in depressions north of Ruffner Bay, on lower Fourth of July and Blackbear Creeks, as well as to the east and south of Atlin. These clayey silty glaciolacustrine materials commonly underlie and flank relatively shallow organic materials. They often occur as mantles or veneers over basal till, and in turn are often mantled or veneered by sandy beach materials, as in the Como Lake area. The pebbly glaciolacustrine beach deposits represent ancient shorelines of glacial Lake Atlin as it shrank to its present size during de-glaciation.

Sieve analysis shows the glaciolacustrine beach materials to be pebbly in texture (82-2991, Table 1). The liquid and plastic limit results reported for this sample are based on analysis of the <2 mm size fraction which represents only some 12% of the total sample. Generally, such pebbly textured materials would not behave in a plastic manner. The beach pebbles are loose, non-consolidated and drain readily to the contact with less permeable materials beneath them. The finer textured glaciolacustrine materials have 69-70% silt, 27-28% clay, and only 2-3% sand (82-2985, 2986, Table 1). These materials are non-consolidated, but moderately compact. They do not drain readily, and being plastic (Table 1) have unfavourable workability characteristics when wet.

3.5 COLLUVIAL MATERIALS

Colluvial materials are products of mass wastage, chiefly consisting of rubbly and blocky bedrock derived material. In the Atlin area extensive aprons of colluvium occur only at the bases of the steep mountain slopes flanking Kennedy Creek. Shallow colluvium also mantles portions of the slopes above the aprons.

The colluvial materials were not analyzed for texture, or Atterberg Limits, but visual and hand texture estimates suggest a blocky rubbly texture (dominantly <256 mm rubble, with lesser larger angular blocks, as well as lesser interstitial sand, silt and clay). The colluvial materials are unconsolidated, very loose and drain readily. Being dominantly rubble and blocks, colluvium would not generally exhibit plastic behavior.

3.6 ORGANIC MATERIALS

Organic materials result from the accumulation and decay of vegetative matter. The organic materials in the Atlin area commonly occur as flat surfaced, 30 to 100 cm deep deposits of partially decomposed mosses and/or sedges. Permafrost is commonly encountered at a depth of approximately 90 cm. The Atlin area organic materials most commonly occur in the centres of long, narrow swales and overlie clayey silty textured glaciolacustrine materials. Above the level of the glacial lake, smaller organic deposits occur locally in depressions between till mantled hummocks.

The organic materials are commonly mesic textured (partially decomposed) and are very compressible with low bearing strengths. The water table is generally at, or near, the surface all year.

3.7 ANTHROPOGENIC MATERIALS

Anthropogenic materials are those that are man-made or man-modified. In the Atlin area they consist primarily of piles of tailings from placer gold mining operations along Pine and McKee creeks.

The anthropogenic materials were not analyzed for texture, or Atterberg Limits, but visual and hand texture estimates indicate gravelly textures (primarily pebbles and cobbles with lesser interstitial sand). The deposits are non-consolidated, loose and drain readily.

3.8 MINERAL SPRING MATERIALS

The tufa mineral spring deposits in the Atlin area more closely resemble surficial materials than consolidated bedrock in many ways. They appear to be chemically dispersed, are compressible and have low bearing strengths. Coral-like tufa is also locally evident and has much more favourable foundation characteristics. The largest springs occur along McKee Creek where they have formed a gently undulating surface mantling the local slopes. Springs also occur in and outside of Atlin. The spring materials are generally constantly wet from spring flow and consequently are often veneered by organic materials. In some areas, harder, precipitated, coral-like tufa forms series of descending pools.

The spring materials were not analyzed for texture or Atterberg Limits, but appear to consist of chemically dispersed (puffy) silt-sized particles. They are generaly compressible and have low bearing strength. The coral-like tufa is hard and has more favourable bearing strengths, but is discontinuous.

3.9 BEDROCK TYPES AND CHARACTERISTICS

A number of distinct types of bedrock outcrop in the Atlin area. Generally massive and hard granitic rocks (coast intrusives) outcrop from Como Lake north. Volcanic graywackes outcrop north of Atlin, quartzites south of Monarch Mountain, diorites and gabbros outcrop at Atlin and Monarch Mountain (Aitken, 1959). The graywackes, quartzites, diorites and gabbros are generally massive and hard, but are commonly interbedded with softer, sheared or fractured metamorphic greenstones (north of Atlin), argillites (south of Monarch Mountain) and serpentenites (at Atlin and on Monarch Mountain). Beds of cherts outcropping south of Monarch Mountain are hard, but highly fractured.

All of the above mentioned bedrocks offer satisfactory foundation support for domestic and light industrial structures. The softer, sheared/fractured metamorphic rocks are more readily excavated than are the hard, massive largely unfractured bedrocks.

4. GEOMORPHIC PROCESSES

Several types of currently active geomorphic processes are evident in the Atlin project area. As some of these processes are hazardous, they are depicted on the Geological Hazards Map as well as on the Terrain Map.

Flooding and subsequent channel shifting, erosion and sedimentation, are significant processes on active fluvial fans at Pine, McKee and Fourth of July Creeks. Field inspection suggests that the fans on Pine and McKee Creeks are flooded regularly and that significant portions of them are regularly affected by channel shifting, massive erosion and deposition of large volumes of sediment. Any portion of these fans should be considered as hazardous for settlement as a major channel shift at the head of the fan during flood could result in extensive damage outside of the present day most disturbed areas. The fan of Fourth of July Creek appears to be less affected by fluvial processes at present, but should still be considered a potentially hazardous site.

The steep, rocky, mountainous slopes of interbedded and commonly fractured/sheared cherts, argillites, conglomerates and breccias that flank Kennendy Creek are subject to occasional rockfall, as evidenced by fresh talus accumulations at their bases. Major rockfalls or rockslides are a possibility on these slopes. In addition, several snow avalanche tracks are evident just beyond the study area boundary (Map 2), suggesting that avalanches might occur in, or extend into portions of the study area. As both rock mass failures and snow avalanches can be extremely destructive, settlement planning should avoid proposing development in areas of observed, or suspected activity (Map 3).

5. TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS

The Terrain Capability for Residential Settlements system involves evaluation of the characteristics of surficial materials and assignment of a moderate, high or low capability rating based on subjective evaluation of the severity of the limitations. A high capability for a given interpretation indicates that optimal conditions for the proposed use exist and that existing constraints can be overcome through proper construction, servicing or maintenance. Moderate capability indicates that moderately favourable conditions exist, but constraints need to be identified in more detail and may require special construction or maintenance techniques to overcome or modify them. Low capability indicates that terrain characteristics may seriously limit the intended use. The constraints make use of the land for that interpretation questionable. Major reclamation, special design and intensive maintenance may be required to overcome or modify the constraints.

In general, the surficial materials having the least number of constraints limiting settlement development are: (1) the gravelly fluvioglacial and non-active fluvial fans and terraces (Map Unit #'s 8, 10), (2) the pebbly glaciolacustrine beach deposits (Map Unit #13) and (3) areas of sandy glaciolacustrine or sandy fluvial fan deposits (Map Unit #19) (Table 2 and Appendix A). These areas are all characterized by relatively gentle slopes and coarse textures that provide for favourable compressibility, bearing strength, workability and frost heave characteristics. However, these coarse textured materials, being very permeable, are less satisfactory for sewage effluent/garbage disposal.

Map units that consist primarily of moderately fine textured morainal materials on moderate slopes (Map Unit #'s 2, 3, 6, 7, 15) have more favourable textures for effluent/garbage disposal, but have less favourable workability, stability and frost heave characteristics than do (1) to (3) above.

Silt rich glaciolacustrine surficial materials (Map Unit #'s 17, 18) have some severe constraints on development due to their finer soil textures. Map units consisting primarily of: (1) steep rock hummocks or scarps (Map Unit #'s 4, 5, 14), (2) organic soils (Map Unit #'s 20, 21, 22), (3) mineral springs (Map Unit #23) and (4) mining waste (Map Unit #24) generally have severe constraints limiting their use for settlement development.

TABLE 2: SUMMARY OF TERRAIN CAPABILITY RATINGS*

SETTLEMENT SUITABILITY MAP UNIT #	TERRAIN CAPABILITY FOR:				
	Septic Tank Filter Fields	Foundations for Low Dwellings	Road and Street Subgrade	Ease of Excavation	Sanitary Landfill
1	M/L**	M/L	M/L	M/L	M/L
2	H	H	M	M	H
3	M	M	M	M	M
4	L/M	L/M	L/M	L/M	L/M
5	L	L	L	L	L
6	M	M	M	M	M
7	M	M/H	M/H	M/H	M/L
8	M	H	H	H	L
9	L	M	M	M	L
10	M	H/M	H/M	H/M	L/M
11	L	L	L	M	L
12	L	M/L	M/L	M/L	L
13	L	H	H	H	L
14	L	L/M	L/M	L/M	L
15	M/L	M	M	M	M/L
16	L/M	M	M	M	L/M
17	M	M	L	M	H
18	M	M/H	L/H	M/H	H/L
19	M	H	H	H	L
20	L	L	L	L	L
21	L	L	L	L	L
22	L/M	L/M	L/M	L/M	L/M
23	L	L	L	L	L
24	L	H	H	H	L

* See Appendix A for: 1) Constraints determining the given capability classes; and,
2) the surficial materials to which the given capability classes apply.

** H - high capability, M - moderate, L - low.
Capability class before the slash is more common than that after.

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APPENDIX A

TERRAIN CABABILITY FOR RESIDENTIAL SETTLEMENTS
MAP UNIT DESCRIPTION AND INTERPRETATIONS

TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #1

Terrain Description:

Dominantly moderately deep to shallow silty gravelly textured morainal material (till) (Unified Textures SM-SC, GM-GC) over hummocky or ridged bedrock; lesser proportion of rock outcrop.

Hydrologic Conditions:

Morainal materials have relatively low permeability at depth, but are generally moderately well drained in the solum; rock is largely impermeable, its surfaces drain rapidly.

Bedrock Conditions:

Depth to bedrock in till is very variable (often 0.5 to 2 m); rock outcrops are generally coarse grained, weakly fractured and hard.

Topography:

Till commonly has 8 to 25° (15 to 45%) slopes mantling hummocky or ridged bedrock; bedrock slopes of 25 to 37° (45 to 75%) are common.

Characteristics and Behavior of Surficial Materials:

Morainal materials are preconsolidated and when dry have good bearing strength and low compressibility. The moderately fine soil textures and weak plastic behavior of the morainal materials may result in reduced stability under wet and/or disturbed conditions. Frost action potential is moderate on moraine. The rock is difficult to excavate.

Terrain Hazards:

Usually none.

Terrain Capability for Septic Tank Filter Fields:

Moderate capability on till due to variable depths to bedrock and localized steep slopes. Low capability on rock outcrops due to lack of surface sediments and to steep slopes.

Terrain Capability for Foundations for Low Dwellings:

Moderate capability on till due to variable depths to often difficult to excavate bedrock, localized steep slopes and moderate frost heave potential. Low capability on bedrock due to difficulty of excavation and steep slopes.

Terrain Capability for Road and Street Subgrade:

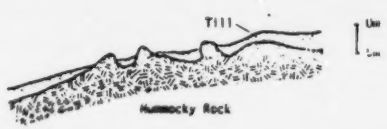
Moderate capability on till due to variable depths to often difficult to excavate bedrock, localized steep slopes and moderate frost heave potential. Low capability for rock due to difficulty of excavation and steep slopes.

Terrain Capability for Ease of Excavation:

Moderate capability on till due to variable depths to often difficult to excavate bedrock, localized steep slopes, moderately fine soil textures and potential sidewall instability when wet. Low capability on rock due to hardness and steep slopes.

Terrain Capability for Sanitary Landfills:

Moderate capability on till due to variable depths to often difficult to excavate bedrock and localized steep slopes. Low capability on bedrock due to lack of surficial materials and steep slopes.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #2

Terrain Description:

Relatively deep, silty gravelly textured morainal materials (till) (Unified Textures SM-SC, GM-GC) on lower slopes.

Hydrologic Conditions:

Although the unweathered morainal material at depth has a low permeability, the solum is more permeable and is commonly moderately well drained.

Bedrock Conditions:

Bedrock is generally deeply buried.

Topography:

Topography is commonly subdued with localized hummocks and incised streamcourses, slopes commonly range from 1 to 8° (2 to 15%), locally 8 to 15° (15 to 25%).

Characteristics and Behavior of Surficial Materials:

The morainal materials are pre-consolidated and when dry have good bearing strength and low compressibility. The moderately fine textures and weak plastic behavior may result in reduced stability under wet and/or disturbed conditions. Frost action potential is moderate.

Terrain Hazards:

Usually none.

Terrain Capability for Septic Tank Filter Fields:

High capability, locally moderate on areas of steeper slopes.

Terrain Capability for Foundations for Low Dwellings:

High capability, locally moderate on areas of steeper slopes. Moderate frost heave potential.

Terrain Capability for Road and Street Subgrade:

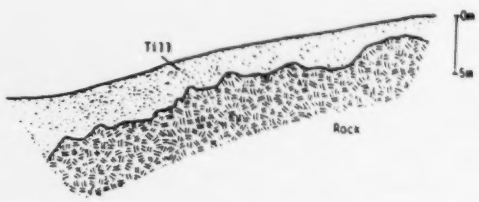
Moderate capability due to moderately fine textures, potential local instability in cuts/fills and moderate frost heave potential.

Terrain Capability for Ease of Excavation:

Moderate capability due to moderately fine soil textures and potential sidewall instability when wet.

Terrain Capability for Sanitary Landfill:

High capability, locally moderate on areas of steep slopes.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #3

Terrain Description:

Silty gravelly textured, moderately deep (commonly 1 to 3 m) morainal materials (till) (Unified Textures SM-SC, GM-GC) blanketing hummocky or subdued bedrock on mid to lower slopes.

Hydrologic Conditions:

Relatively low permeability at depth. Surface soil is generally more permeable and is moderately well drained.

Bedrock Conditions:

Bedrock is generally buried.

Topography:

Uniform, subdued or hummocky surfaces. Slopes commonly 15 to 35° (25 to 70%).

Characteristics and Behavior of Surficial Materials:

Till is preconsolidated and has good bearing strength and low compressibility when dry. The moderately fine soil textures and weak plastic behavior may result in reduced stability under wet and/or disturbed conditions. Frost action potential is moderate.

Terrain Hazards:

Localized minor failures may occur on scarps of incised streams.

Terrain Capability for Septic Tank Filter Fields:

Moderate capability due to steep slopes and variable depths to bedrock.

Terrain Capability for Foundations for Low Dwellings:

Moderate capability due to steep slopes, variable depths to often difficult to excavate bedrock and moderate frost heave potential.

Terrain Capability for Road and Street Subgrade:

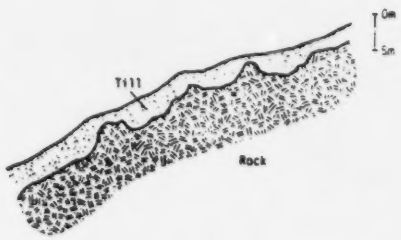
Moderate capability due to moderately fine soil textures, potential local instability in cuts/fills, variable depths to often difficult to excavate bedrock and moderate frost heave potential.

Terrain Capability for Ease of Excavation:

Moderate capability due to moderately fine textures, potential sidewall instability when wet and variable depths to often difficult to excavate bedrock.

Terrain Capability for Sanitary Landfill:

Moderate capability due to steep slopes and variable depths to often difficult to excavate bedrock.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #4

Terrain Description:

Primarily steep sided hummocky or ridged bedrock outcrops; lesser silty gravelly textured deep and shallow morainal materials (till) (Unified Textures SM-SC, GM-GC) on lower slopes and in swales.

Hydrologic Conditions:

Rock is largely impermeable and its exposed surfaces drain rapidly; morainal materials have relatively low permeability at depth, but are generally more permeable and are moderately well drained in the solum.

Bedrock Conditions:

Bedrock is generally coarse grained, weakly fractured and hard.

Topography:

Bedrock slopes of 25 to 37° (45 to 75%) are common; slopes commonly range between 8 to 25° (15 and 45%) on morainal materials that mantle/veneer rock hummocks/ridges.

Characteristics and Behavior of Surficial Materials:

Rock is difficult to excavate. Morainal materials are pre-consolidated and when dry have good bearing strength and low compressibility. The moderately fine soil textures and weak plastic behavior of the morainal materials may result in reduced stability under wet and/or disturbed conditions. Frost action potential for till is moderate.

Terrain Hazards:

Rock fall/rock sliding occurs rarely on steeper bedrock scarps.

Terrain Capability for Septic Tank Filter Fields:

Low capability on rock due to lack of surface sediments and steep slopes. Moderate for till due to variable depths to bedrock and steep slopes.

Terrain Capability for Foundations for Low Dwellings:

Low capability for bedrock due to difficulty of excavation and steep slopes. Moderate for till due to variable depths to often difficult to excavate bedrock and steep slopes.

Terrain Capability for Road and Street Subgrade:

Low capability due to difficulty of excavation and steep slopes. Moderate for till due to variable depths to often difficult to excavate bedrock, localized steeper slopes, potential cut/fill instability when wet and moderate frost heave potential.

Terrain Capability for Ease of Excavation:

Low capability on rock. Moderate capability on till due to moderately fine soil textures, variable depths to often difficult to excavate bedrock and potential sidewall instability when wet.

Terrain Capabiltiy for Sanitary Landfill:

Low capabiltiy on rock. Moderate capability on till due to steep slopes and variable depths to often difficult to excavate bedrock.

TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #5

Terrain Description:

Hummocky and/or ridged bedrock outcroppings, extensive areas of rock scarps.

Hydrologic Conditions:

Rock is largely impermeable and its exposed surfaces drain rapidly.

Bedrock Conditions:

Bedrock is generally coarse grained, weakly fractured and hard.

Topography:

Slopes in excess of 37° (75%) are common.

Characteristics and Behavior of Surficial Materials:

Little or no surficial material present.

Terrain Hazards:

Rock fall, rock sliding or rolling occurs off rock scarps with accumulation at their bases. Locally snow avalanches run down steep rock scarps.

Terrain Capability for Septic Tank Filter Fields:

Low capability due to rock surface and steep slopes.

Terrain Capability for Foundations for Low Dwellings:

Low capability due to difficulty of excavation and steep slopes.

Terrain Capability for Road and Street Subgrade:

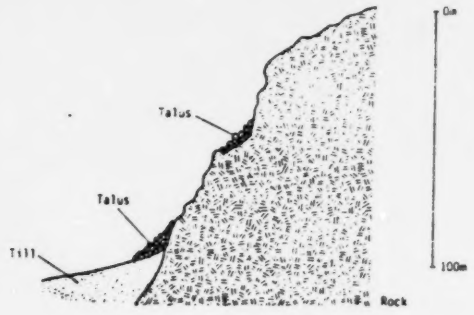
Low capability due to difficulty of excavation and steep slopes.

Terrain Capability for Ease of Excavation:

Low capability due to hardness of rock and steep slopes.

Terrain Capability for Sanitary Landfill:

Low capability due to steep slopes and bedrock surface.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #6

Terrain Description:

Moderately deep and shallow silty gravelly textured morainal materials (till) (Unified Textures SM-SC, GM-GC) over hummocky or ridged bedrock.

Hydrologic Conditions:

Morainal materials have relatively low permeability at depth, but are generally moderately well drained in the solum.

Bedrock Conditions:

Depth to bedrock is very variable (often 0.5 to 2 m).

Topography:

Till commonly has 8 to 25° (15 to 45%) slopes, mantling or veneering hummocky or ridged bedrock.

Characteristics and Behavior of Surficial Materials:

Morainal materials are pre-consolidated and when dry have good bearing strength and low compressibility. The moderately fine soil textures and weak plastic behavior of the morainal materials may result in reduced stability under wet and/or disturbed conditions. Frost action potential is moderate.

Terrain Hazards:

Usually none.

Terrain Capability for Septic Tank Filter Fields:

Moderate capability due to variable depths to often difficult to excavate bedrock and localized steep slopes.

Terrain Capability for Foundations for Low Dwellings:

Moderate capability due to variable depth to often difficult to excavate bedrock, localized steep slopes and moderate frost heave potential.

Terrain Capability for Road and Street Subgrade:

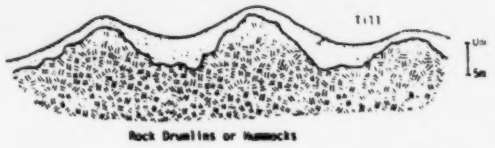
Moderate capability due to variable depths to often difficult to excavate bedrock, localized steep slopes and moderate frost heave potential.

Terrain Capability for Ease of Excavation:

Moderate capability due to variable depths to often difficult to excavate bedrock, localized steep slopes, moderately fine soil textures and potential sidewall instability when wet.

Terrain Capability for Sanitary Landfill:

Moderate capability due to variable depths to often difficult to excavate bedrock and localized steep slopes.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #7

Terrain Description:

Dominantly moderately deep and shallow, silty gravelly textured morainal materials (till) (Unified Textures SM-SC, GM-GC); lesser gravelly fluvioglacial terraces or fans (GW-GM).

Hydrologic Conditions:

Morainal materials have relatively low permeability at depth, but are generally more permeable and are moderately well drained in the solum. The fluvioglacial deposits are highly permeable and rapidly drained.

Bedrock Conditions:

Depth to bedrock in till is very variable (often 0.5 to 2.0 m). Bedrock seldom outcrops.

Topography:

The morainal materials commonly are hilly with slopes up to 25° (45%), whereas the fluvioglacial materials generally have slopes less than 8° (15%).

Characteristics and Behavior of Surficial Materials:

The morainal materials are pre-consolidated, have good bearing strength, low compressibility and moderate frost heave potential. The fluvioglacial materials are generally cohesionless, have a low compressibility and good bearing strength.

Terrain Hazards:

Usually none.

Terrain Capability for Septic Tank Filter Fields:

Moderate capability on morainal materials due to variable depths to bedrock and localized steep slopes. Moderate capability on fluvioglacial materials due to permeable materials and potential for groundwater contamination.

Terrain Capability for Foundations for Low Dwellings:

Moderate capability on till materials due to variable depths to often difficult to excavate bedrock, localized steep slopes and moderate frost heave potential. High capability on fluvioglacial materials.

Terrain Capability for Road and Street Subgrade:

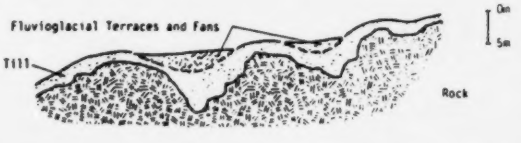
Moderate capability on till due to variable depths to often difficult to excavate bedrock, localized steep slopes and moderate frost heave potential. High capability on fluvioglacial materials.

Terrain Capability for Ease of Excavation:

Moderate capability on till due to variable depths to often difficult to excavate bedrock, localized steep slopes and potential sidewall instability when wet. High capability for fluvioglacial materials.

Terrain Capability for Landfill:

Moderate capability on till due to variable depths to often difficult to excavate bedrock and localized steep slopes. Low capability on fluvioglacial materials due to permeable materials and potential for groundwater contamination.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #8

Terrain Description:

Gravelly fluvioglacial and fluvial fans and terraces (Unified Textures GW-GM), often capped with a thin veneer of eolian/fluvial sands.

Hydrologic Conditions:

These gravelly, sandy fans and terraces are highly permeable and rapidly drained. Downslope drainage along a subsurface of moraine or bedrock at depth is probable.

Bedrock Conditions:

Usually deeply buried.

Topography

Slopes are usually less than 5° (10%) on fan or terrace surfaces but locally may exceed 25° (45%) on scarps.

Characteristics and Behavior of Surficial Materials

Fluvioglacial gravels and sands are generally cohesionless, have low compressibility and good bearing strength.

Terrain Hazards:

Scarp faces may be subject to very localized small failures and surface erosion.

Terrain Capability for Septic Tank Filter Fields:

Moderate capability due to permeable materials and potential for groundwater contamination.

Terrain Capability for Foundations for Low Dwellings:

High capability.

Terrain Capability for Road and Street Subgrade:

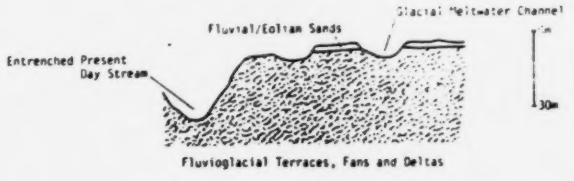
High capability.

Terrain Capability for Ease of Excavation:

High capability.

Terrain Capability for Sanitary Landfill:

Low capability due to permeable materials and potential for groundwater contamination.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #9

Terrain Description:

Gravelly fluvioglacial materials (Unified Textures GW-GM) with hummocky, ridged or depressional topography.

Hydrologic Conditions:

These gravelly, sandy fans and terraces are highly permeable and rapidly drained. Downslope drainage along a subsurface of moraine or bedrock is probable.

Bedrock Conditions:

Usually deeply buried.

Topography:

Steep slopes in excess of 25° (45%) are common, but more gentle slopes occur locally.

Characteristics and Behavior of Surficial Materials:

Fluvioglacial sands and gravels are generally cohesionless, have low compressibility and good bearing strength.

Terrain Hazards:

Steep slopes may be subject to very localized small failures and surface erosion.

Terrain Capability for Septic Tank Filter Fields:

Low capability due to permeable materials, potential for groundwater contamination and steep slopes.

Terrain Capability for Foundations for Low Dwellings:

Moderate capability due to steep slopes.

Terrain Capability for Road and Street Subgrade:

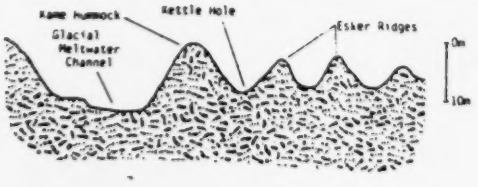
Moderate capability due to steep slopes.

Terrain Capability for Ease of Excavation:

Moderate capability due to steep slopes.

Terrain Capability for Sanitary Landfill:

Low capability due to permeable materials, potential for groundwater contamination and steep slopes.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #10

Terrain Description:

Gravelly fluvioglacial materials (Unified Textures GW-GM) in the swales; deep and shallow silty gravelly textured morainal materials (till) (SM-SC, GM-GC) on the hills.

Hydrologic Conditions:

The fluvioglacial gravels and sands are highly permeable and rapidly drained. The morainal materials have relatively low permeability at depth, but are generally more permeable and are moderately well drained in the solum.

Bedrock Conditions:

Depth to bedrock in till is very variable (often 0.5 to 2.0 m). Bedrock seldom outcrops.

Topography:

The fluvioglacial materials generally have slopes less than 8° (15%) whereas the morainal materials are commonly on hillsides and have slopes up to 25° (45%).

Characteristics and Behavior of Surficial Materials:

The fluvioglacial sands and gravels are generally cohesionless, have a low compressibility and good bearing strength. The morainal materials are pre-consolidated, and when dry have good bearing strength and low compressibility. The moderately fine textures and weak plastic behavior of the till may result in reduced stability under wet and/or disturbed conditions. Frost action potential is moderate on till.

Terrain Hazards:

Usually none.

Terrain Capability for Septic Tank Filter Fields:

Moderate capability on fluvioglacial materials due to permeable materials and potential for groundwater contamination. Moderate capability on morainal materials due to variable depths to bedrock and localized steep slopes.

Terrain Capability for Foundations for Low Dwellings:

High capability on fluvioglacial materials. Moderate capability on till due to variable depths to often difficult to excavate bedrock, localized steep slopes and moderate frost heave potential.

Terrain Capability for Road and Street Subgrade:

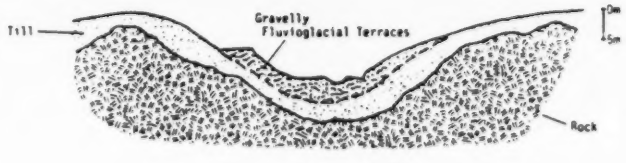
High capability on fluvioglacial materials. Moderate capability on till due to variable depths to often difficult to excavate bedrock, localized steep slopes and moderate frost heave potential.

Terrain Capability for Ease of Excavation:

High capability for fluvioglacial materials. Moderate capability on till due to variable depths to often difficult to excavate bedrock, localized steep slopes and potential sidewall instability when wet.

Terrain Capability for Sanitary Landfill:

Low capability on fluvioglacial materials due to permeable materials and potential for groundwater contamination. Moderate capability on till due to variable depths to often difficult to excavate bedrock and localized steep slopes.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #11

Terrain Description:

Gravelly active fluvial fans and flodplains (Unified Textures GW-GP), generally with many bars and channels.

Hydrologic Conditions:

Subject to annual or periodic inundation, channel shifting and sediment deposition. Water table depth near the surface part of the year. The fluvial gravels and sands are very permeable.

Bedrock Conditions:

Bedrock outcrops occasionally on banks.

Topography:

Channel sides and bars commonly have slopes up to 5° (10%), the floodplain less than 3° (5%).

Characteristics and Behavior of Surficial Materials:

The fluvial gravels and sands are cohesionless, have a low compressibility and good bearing strength.

Terrain Hazards:

Subject to annual or periodic inundation, channel shifting and sediment deposition.

Terrain Capability for Septic Tank Filter Fields:

Low capability due to seasonal high water tables, permeable materials and potential for watercourse contamination.

Terrain Capability for Foundations for Low Dwellings:

Low capability due to flood hazard and seasonal high water table.

Terrain Capability for Road and Street Subgrade:

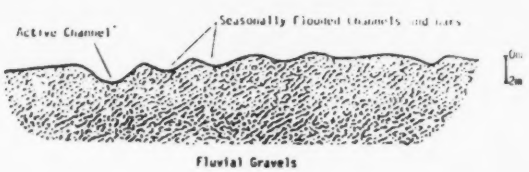
Low capability due to potential erosion during flooding and seasonal high water table.

Terrain Capability for Ease of Excavation:

Moderate capability due to seasonal flooding and seasonal high water table.

Terrain Capability for Sanitary Landfill:

Low capability due to flood hazard, permeable materials and potential for watercourse contamination.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #12

Terrain Description:

Pebbly glaciolacustrine beach deposits (Unified Texture GP) mantling and veneering hummocky rock; lesser hummocky rock outcrops.

Hydrologic Conditions:

The beach deposits are extremely permeable and rapidly drained. The rock outcrops are largely impermeable and their exposed surfaces drain rapidly.

Bedrock Conditions:

Depth to bedrock in the beach deposits is very variable often 0.5 to 1.0 m. Rock outcrops are commonly coarse grained, weakly fractured and hard.

Topography:

The beach deposits commonly have slopes of 8 to 25° (15 to 45%). The rock hummocks often have slopes greater than 25° (45%).

Characteristics and Behavior of Surficial Materials:

The pebbly beach deposits are generally cohesionless, have a low compressibility and good bearing strength. The rock is locally difficult to excavate.

Terrain Hazards:

Usually none.

Terrain Capability for Septic Tank Filter Fields:

Low capability on beach deposits due to extremely permeable materials, potential for groundwater contamination, slope and variable depth to bedrock. Low capability for rock.

Terrain Capability for Foundations for Low Dwellings:

Moderate capability on beach deposits due to variable depths to often difficult to excavate bedrock and localized steep slopes. Low capability on bedrock due to difficulty of excavation and steep slopes.

Terrain Capability for Road and Street Subgrade:

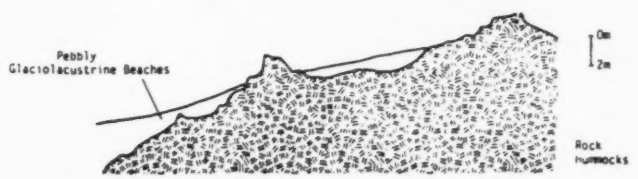
Moderate capability on beach deposits due to variable depths to often difficult to excavate bedrock and localized steep slopes. Low capability on rock due to difficulty of excavation and steep slopes.

Terrain Capability for Ease of Excavation:

Moderate capability for beach deposits due to variable depths to often difficult to excavate bedrock and localized steep slopes. Low capability on rock due to hardness and steep slopes.

Terrain Capability for Sanitary Landfill:

Low capability on beach deposits due to extremely permeable materials and potential for groundwater contamination. Low capability on rock due to lack of surficial sediments and steep slopes.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #13

Terrain Description:

Relatively deep, pebbly glaciolacustrine beach deposits (Unified Textures GP).

Hydrologic Conditions:

The beach deposits are very permeable and rapidly drained. Downslope drainage along a subsurface of till or rock is probable.

Bedrock Conditions:

Generally deeply buried.

Topography:

The land surface is commonly undulating or uniform, with slopes of less than 8° (15%).

Characteristics and Behavior of Surficial Materials:

The pebbly beach deposits are generally cohesionless, have a low compressibility and good bearing strength.

Terrain Hazards:

Usually none.

Terrain Capability for Septic Tank Filter Fields:

Low capability due to extremely permeable materials and potential for groundwater contamination.

Terrain Capability for Foundations for Low Dwellings:

High capability.

Terrain Capability for Road and Street Subgrade:

High capability.

Terrain Capability for Ease of Excavation:

High capability.

Terrain Capability for Sanitary Landfill:

Low capability on beach deposits due to extremely permeable materials and potential for groundwater contamination.

TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #14

Terrain Description:

Dominantly hummocky rock outcrops; lesser deep and shallow, pebbly glaciolacustrine beach deposits (Unified Texture GP).

Hydrologic Conditions:

The rock outcrops are largely impermeable and their exposed surfaces drain rapidly. The beach deposits are extremely permeable and rapidly drained.

Bedrock Conditions:

Rock outcrops frequently, bedrock is commonly coarse grained, weakly fractured and hard.

Topography:

Slopes of 25 to 37° (45 to 75%) or greater are common on the rock hummocks. Slopes are commonly 14° (25%) or less on the beach deposits.

Characteristics and Behavior of Surficial Materials:

The rock is difficult to excavate. The pebbly beach deposits are generally cohesionless, have a low compressibility and good bearing strength.

Terrain Hazards:

Usually none.

Terrain Capability for Septic Tank Filter Fields:

Low capability for rock. Low capability for beach deposits due to extremely permeable materials, potential for groundwater contamination, variable depths to bedrock and slope.

Terrain Capability for Foundations for Low Dwellings:

Low capability on rock due to difficulty of excavation and steep slopes. Moderate capability on beach deposits due to variable depths to often difficult excavate bedrock and local steep slopes.

Terrain Capability for Road and Street Subgrade:

Low capability on rock due to difficulty of excavation and steep slopes. Moderate capability on beach deposits due to variable depths to often difficult to excavate bedrock and local steep slopes.

Terrain Capability for Ease of Excavation:

Low capability on rock due to hardness and steep slopes. Moderate capability for beach deposits due to variable depths to often difficult to excavate bedrock and local steep slopes.

Terrain Capability for Sanitary Landfill:

Low capability on rock due to lack of surficial sediments and steep slopes. Low capability on beach deposits due to extremely permeable materials, potential for groundwater contamination and variable depths to often difficult to excavate bedrock.

TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #15

Terrain Description:

Dominantly deep and shallow, silty gravelly textured morainal materials (till) (Unified Textures SM-SC, GM-GC); lesser proportion of deep and shallow pebbly glaciolacustrine beach deposits (GP).

Hydrologic Conditions:

Morainal materials have relatively low permeability at depth, but are generally more permeable and are moderately well drained in the solum. The beach materials are extremely permeable and rapidly drained.

Bedrock Conditions:

Depth to bedrock in both materials is very variable (often 0.5 to 2.0 m).

Topography:

The hills are generally blanketed or veneered by till with slopes of between 8 to 25° (15 to 45%). The lower swales or subdued land surfaces are generally blanketed or veneered by the beach pebbles with slopes of between 5 and 14° (10 and 25%).

Characteristics and Behavior of Surficial Materials:

The morainal materials are pre-consolidated, and when dry have good bearing strength and low compressibility. The moderately fine textures and weak plastic behavior of the morainal materials may result in reduced stability under wet and/or disturbed conditions. Frost action potential is moderate on till. The pebbly beach deposits are cohesionless, have good bearing strength and low compressibility.

Terrain Hazards:

Usually none.

Terrain Capability for Septic Tank Filter Fields:

Moderate capability on till due to variable depths to bedrock and localized steep slopes. Low capability for the beach deposits due to extreme permeability, potential for groundwater contamination, variable depths to bedrock and slope.

Terrain Capability for Foundations for Low Dwellings:

Moderate capability on till due to variable depths to often difficult to excavate bedrock, localized steep slopes and moderate frost heave potential. Moderate capability on beach deposits due to variable depths to bedrock and localized steep slopes.

Terrain Capability for Road and Street Subgrade:

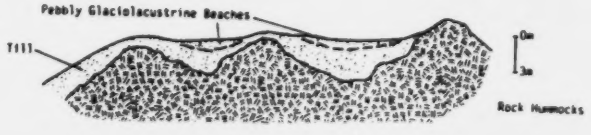
Moderate capability for till due to variable depths to often difficult to excavate bedrock, localized steep slopes and moderate frost heave potential. Moderate potential on beach deposits due to variable depths to bedrock and slope.

Terrain Capability for Ease of Excavation:

Moderate capability on till due to variable depths to often difficult to excavate bedrock, localized steep slopes, moderately fine soil textures and potential sidewall instability when wet. Moderate capability on beach deposits due to variable depths to bedrock and slope.

Terrain Capability for Sanitary Landfill:

Moderate capability for moraine due to variable depths to often difficult to excavate bedrock and localized steep slopes. Low capability for beach deposits due to extremely permeable materials and potential for groundwater contamination.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #16

Terrain Description:

Dominantly deep and shallow, pebbly glaciolacustrine beach deposits (Unified Texture GP); lesser proportion of deep, silty gravelly textured morainal material (till) (SM-SC, GM-GC); some rock outcroppings.

Hydrologic Conditions:

The beach materials are extremely permeable and rapidly drained. Downslope drainage along a subsurface of till or rock is probable. The morainal materials have relatively low permeability at depth, but are generally more permeable and are moderately well drained in the solum.

Bedrock Conditions:

Depth to bedrock in the beach deposits is very variable (often 0.5 to 2.0 m).

Topography:

The swales and subdued surfaces are generally blanketed or veneered by the beach pebbles with slopes of between 5 and 12° (10 and 25%). The hills are subdued, and generally till covered with slopes of between 8 to 14° (15 and 25%).

Characteristics and Behavior of Surficial Materials:

The pebbly beach deposits are cohesionless, have good bearing strength and low compressibility. The morainal materials are pre-consolidated, have good bearing strengths, low compressibility and moderate frost heave potential.

Terrain Hazards:

Usually none.

Terrain Capability for Septic Tank Filter Fields:

Low capability on beach deposits due to extreme permeability, potential for groundwater contamination and variable depths to till or bedrock. Moderate capability on till due to variable depths to bedrock and localized steep slopes.

Terrain Capability for Foundations for Low Dwellings:

Moderate capability on beach deposits due to variable depths to often difficult to excavate bedrock and localized steep slopes. Moderate capability on till due to variable depths to bedrock, localized steep slopes and moderate frost heave potential.

Terrain Capability for Road and Street Subgrade:

Moderate capability on beach deposits due to variable depths to often difficult to excavate bedrock and localized steep slopes. Moderate capability on till due to variable depths to bedrock, localized steep slopes and moderate frost heave potential.

Terrain Capability for Ease of Excavation:

Moderate capability on beach deposits due to variable depths to often difficult to excavate bedrock and localized steep slopes. Moderate capability on till due to variable depths to bedrock, localized steep slopes, moderately fine soil textures and potential sidewall instability when wet.

Terrain Capability for Sanitary Landfills:

Low capability on beach deposits due to extremely permeable materials and potential for groundwater contamination. Moderate capability on till due to variable depths to often difficult to excavate bedrock and localized steep slopes.

TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #17

Terrain Description:

Level or gently undulating surfaces of deep and shallow clay and silt rich glaciolacustrine deposits (Unified Texture CL) overlying till.

Hydrologic Conditions:

The silt rich glaciolacustrine deposits have low permeabilities and are moderately well to imperfectly drained in the solum. Localized depressional areas are poorly drained and filled with organics.

Bedrock Conditions:

Usually deeply buried.

Topography:

The land surface is commonly level, gently undulating or gently rolling. Slopes commonly are less than 8° (15%).

Characteristics and Behavior of Surficial Materials:

Being silt rich and moderately plastic, these glaciolacustrine deposits may be subject to compression under load, and differential settling when wet. Frost heave potential is high. They have relatively low bearing strengths and poor workability when wet.

Terrain Hazards:

Slumps are probable on natural escarpments or cutfaces.

Terrain Capability for Septic Tank Filter Fields:

Moderate capability due to fine soil textures and limited permeability.

Terrain Capability for Foundations for Low Dwellings:

Moderate capability due to compressibility, frost heave potential, potential for differential settling, relatively low bearing strengths and poor workability when wet.

Terrain Capability for Road and Street Subgrade:

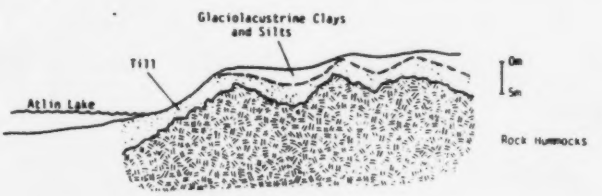
Low capability due to poor workability when wet, compressibility, potential for differential settling, frost heave potential and relatively low bearing strengths.

Terrain Capability for Ease of Excavation:

Moderate capability due to poor workability when wet.

Terrain Capability for Sanitary Landfill:

High capability except in the localized minor areas of poor drainage, organics and small surface water bodies.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #18

Terrain Description:

Dominantly level or gently undulating surfaces of glaciolacustrine clays and silts (Unified Texture CL); lesser sandy glaciolacustrine beach or sandy fan deposits (SP-SW).

Hydrologic Conditions:

The silt rich glaciolacustrine deposits have low permeabilities and commonly range from moderately well to imperfectly drained in the solum. The sands are rapidly drained and very permeable. However, subsurface drainage or perched water tables upon the underlying glaciolacustrine materials is probable.

Bedrock Conditions:

Usually deeply buried.

Topography:

The land surface is usually level, gently undulating or gently rolling. Slopes commonly are less than 8° (15%).

Characteristics and Behavior of Surficial Materials:

The silt rich and moderately plastic glaciolacustrine deposits may be subject to compression under load and differential settling when wet. Frost heave potential is high. They have relatively low bearing strengths and poor workability when wet. The sands have better bearing strengths and better compressibility characteristics.

Terrain Hazards:

Slumps are probable on natural escarpments or cutfaces in silt rich glaciolacustrine deposits.

Terrain Capability for Septic Tank Filter Fields:

Moderate capability on silt rich glaciolacustrine due to limited permeability. Moderate capability on the sands due to excess permeability and potential for groundwater contamination (perched water table).

Terrain Capability for Foundations for Low Dwellings:

Moderate potential on silt rich glaciolacustrine due to compressibility, frost heave potential, potential for differential settling, relatively low bearing strengths and poor workability when wet. High capability on the sands.

Terrain Capability for Road and Street Subgrade:

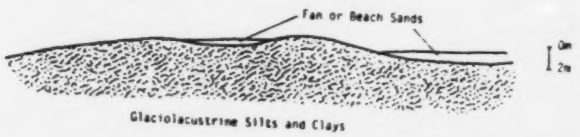
Low capability on glaciolacustrine silts due to poor workability when wet, compressibility, potential for differential settling, frost heave potential and relatively low bearing strengths. High capability on the sands.

Terrain Capability for Ease of Excavation:

Moderate capability on glaciolacustrine silts due to poor workability when wet. High capability on the sands.

Terrain Capability for Sanitary Landfill:

High capability on the glaciolacustrine silts. Low capability on the sands due to permeable materials and potential for groundwater contamination (perched water table).



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #19

Terrain Description:

Sand textured, glaciolacustrine beach or fluvial fan deposits (Unified Textures SP-SW).

Hydrologic Conditions:

The sands are highly permeable and rapidly drained. Subsurface drainage or perched water tables upon underlying glaciolacustrine silts, moraine, or rock is probable.

Bedrock Conditions:

Usually deeply buried.

Topography:

The sands often blanket or veneer rolling or undulating subsurface deposits. Slopes are commonly less than 8° (15%).

Characteristics and Behavior of Surficial Materials:

The sands have good bearing strengths and low compressibility.

Terrain Hazards:

Usually none.

Terrain Capability for Septic Tank Filter Fields:

Moderate capability on the sands due to permeable soils and potential for groundwater contamination (perched water table).

Terrain Capability for Foundations for Low Dwellings:

High capability.

Terrain Capability for Road and Street Subgrade:

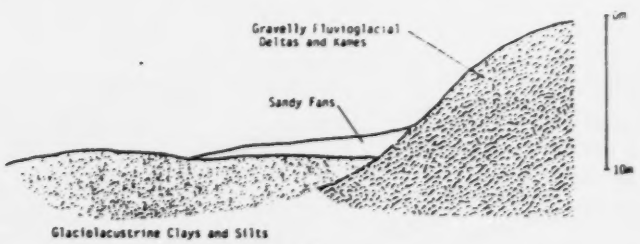
High capability.

Terrain Capability for Ease of Excavation:

High capability.

Terrain Capability for Sanitary Landfill:

Low capability due to permeable materials and potential for groundwater contamination (perched water table).



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #20

Terrain Description:

Mesic and fibric textured organic deposits (Unified Texture Pt) in depressions in the topography.

Hydrologic Conditions:

Although permeable, the organics are nearly always saturated, with the water table at, or near, the surface year around.

Bedrock Conditions:

Usually deeply buried.

Topography:

The organics are commonly level, but may be micro-mounded.

Characteristics and Behavior of Surficial Materials:

The organics are highly compressible and have low bearing strengths. They are commonly frozen at depths of 0.8 to 1.5 m.

Terrain Hazards:

Usually inundated.

Terrain Capability for Septic Tank Filter Fields:

Low capability due to high water table, poor soil drainage, frozen subsoil and potential for water contamination.

Terrain Capability for Foundations for Low Dwellings:

Low capability due to low bearing strength, compressibility, high water table and frozen subsoil.

Terrain Capability for Road and Street Subgrade:

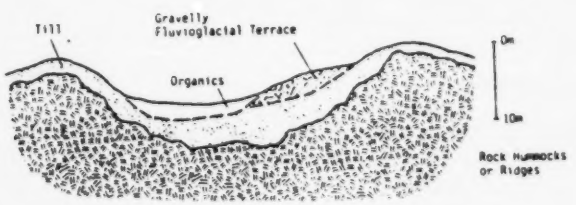
Low capability due to low bearing strength, compressibility, high water table and frozen subsoil.

Terrain Capability for Ease of Excavation:

Low capability because of poor workability, high water table and frozen subsoil.

Terrain Capability for Sanitary Landfill:

Low capability due to high water table, very poor soil drainage and potential for water contamination.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #21

Terrain Description:

Dominantly mesic and fibric textured organic deposits (Unified Texture Pt) in depressions; lesser clay and silt rich glaciolacustrine deposits (CL) on the edges of the depressions, generally capped by a thin organic layer.

Hydrologic Conditions:

The organics are nearly always saturated, with the water table at, or near the surface year round. The glaciolacustrine silts are commonly poorly drained and having restricted permeability, maintain high water tables for most of the year.

Bedrock Conditions:

Usually deeply buried.

Topography:

The organics and glaciolacustrine deposits are generally level, but may be micro-mounded.

Characteristics and Behavior of Surficial Materials:

The organics are highly compressible, have low bearing strengths and are commonly frozen at depths of 0.8 to 1.2 m. The glaciolacustrine silts may be suject to compression under load and differential settling . Frost heave potential on the glaciolacustrine materials is high. They have relatively low bearing strengths and poor workability.

Terrain Hazards:

Usually inundated. Glaciolacustrine silts may be subject to sidewall failure if excavated.

Terrain Capability for Septic Tank Filter Fields:

Low capability in organics due to high water table, potential for water contamination and frozen subsoils. Low capability in glaciolacustrine due to low permeability, high water table and potential for water contamination.

Terrain Capability for Foundations for Low Dwellings:

Low capability for both organics and silty glaciolacustrine due to compressibility, differential settling, low bearing strengths and high water tables. The organics commonly have permafrost.

Terrain Capability for Road and Street Subgrade:

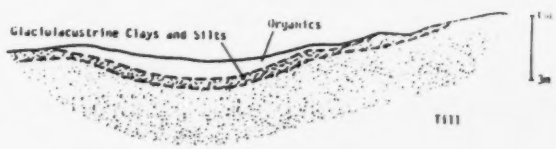
Low capability for both organics and silty glaciolacustrine due to compressibility, differential settling, low bearing strengths and high water tables. The organics commonly have permafrost.

Terrain Capability for Ease of Excavation:

Low capability on the organics and silty glaciolacustrine because of poor workability and high water tables. The organics are commonly frozen at depth.

Terrain Capability for Sanitary Landfill:

Low capability on the organics and silty glaciolacustrine due to high water tables and potential for water contamination.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #22

Terrain Description:

Dominantly mesic and fibric textured organic deposits (Unified Texture Pt) in depressions; lesser deep and shallow, silty gravelly textured till over hummocky bedrock (SM-SC, GM-GC).

Hydrologic Conditions:

The organics are nearly always saturated, with the water table near, or at, the surface year around. The morainal materials are generally moderately well drained with limited permeabilities at depth.

Bedrock Conditions:

Depth to bedrock in till is very variable (often 0.5 to 2.0 m).

Topography:

The organics are generally level, occasionally micro-mounded. The morainal materials usually mantle small bedrock hills and have slopes of up to 14° (25%).

Characteristics and Behavior of Surficial Materials:

The organics are highly compressible, have low bearing strengths and are commonly frozen at 0.8 to 1.2 m. The morainal materials have good bearing strength, low compressibility and moderate frost action potential. However, the moderately fine textures and weak plastic behavior of the morainal materials may result in reduced stability under wet and/or disturbed condition.

Terrain Hazards:

Usually inundated.

Terrain Capability for Septic Tank Filter Fields:

Low capability on organics due to high water tables, potential for water contamination and permafrost. Moderate capability on till due to variable depths to bedrock.

Terrain Capability for Foundations for Low Dwellings:

Low capability for organics due to low bearing strength, compressibility, high water table and permafrost. Moderate capability for till due to variable depths to often difficult to excavate bedrock and moderate frost heave potential.

Terrain Capability for Road and Street Subgrade:

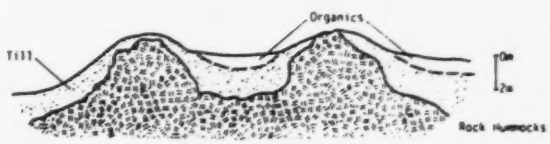
Low capability on organics due to low bearing strength, compressibility, high water table and permafrost. Moderate capability on till due to moderately fine soil textures, potential local instability in cuts/fills, variable depths to often difficult to excavate bedrock and moderate frost heave potential.

Terrain Capability for Ease of Excavation:

Low capability on organics due to poor workability, high water table and frozen subsoil. Moderate capability on till due to moderately fine soil textures, potential sidewall instability when wet and variable depths to often difficult to excavate bedrock.

Terrain Capability for Sanitary Landfill:

Low capability for organics due to high water table and potential for water contamination. Moderate capability on moraine due to proximity to organics and water bodies.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #23

Terrain Description:

Areas subject to overland flow and/or seepage from mineral springs; includes silt like tufa, porous coral like tufa and evaporite deposits.

Hydrologic Conditions:

Generally subject to flow throughout the year, restricted permeability and imperfect to poor soil drainage.

Bedrock Conditions:

Some tufa is silt like, often coated with salt crystals in evaporite areas. Other tufa resembles soft coral deposits.

Topography:

The springs deposits generally veneer uniform, hummocky or ridged morainal materials and commonly have slopes from 0 to 8° (0 to 15%).

Characteristics and Behavior of Surficial Materials:

The soft tufa is somewhat compressible and has moderate bearing strength. The harder tufa is largely incompressible and has a high bearing strength.

Terrain Hazards:

Usually inundated or subject to seepage.

Terrain Capability for Septic Tank Filter Fields:

Low capability because of high water table and presence of tufa.

Terrain Capability for Foundations for Low Dwellings:

Low capability due to high water table, variable compressibility and variable bearing strength.

Terrain Capability for Road and Street Subgrade:

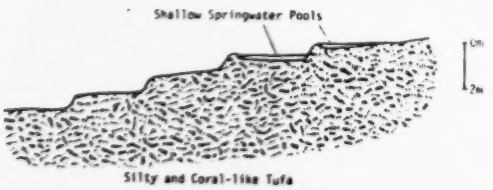
Low capability because of high water table, variable compressibility and variable bearing strength.

Terrain Capability for Ease of Excavation:

Low capability due to high water table and poor workability in many areas.

Terrain Capability for Sanitary Landfill:

Low capability due to the high water table and potential for water contamination.



TERRAIN CAPABILITY FOR RESIDENTIAL SETTLEMENTS - MAP UNIT #24

Terrain Description:

Anthropogenic deposits, often consisting of steep sided mounds of washed gravels and sands from gold extraction operations adjacent to creeks.

Hydrologic Conditions:

Generally very permeable and rapidly drained. In places, these deposits are on the floodplain and subject to partial inundation and erosion.

Bedrock Conditions:

Bedrock exposures are locally present in the excavated areas.

Topography:

These deposits often consist of steep sided hummocks with slopes from 25 to 35° (45 to 70%) or greater. In some areas slopes are much less.

Characteristics and Behavior of Surficial Materials:

The gravelly mining waste materials are cohesionless, have low compressibility and good bearing strength.

Terrain Hazards:

Local minor failure during settling of piles may be expected. Surface erosion occurs locally. Portions of these deposits are regularily inundated . Local failures on excavated scarps are probable.

Terrain Capability for Septic Tank Filter Fields:

Low capability due to permeable materials and potential for watercourse contamination.

Terrain Capability for Foundations for Low Dwellings:

High capability if leveled and off the floodplain.

Terrain Capability for Road and Street Subgrade:

High capability if leveled and off the floodplain.

Terrain Capability for Ease of Excavation:

High capability if leveled and off the floodplain.

Terrain Capability for Sanitary Landfill:

Low capability due to permeable materials and potential for watercourse contamination.